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A scientific heritage in plant physiology from an older generation

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Scientific knowledge passes from generation to generation. The scientific achievements of one generation not only deepen our understanding of nature, but also provide the basis for the research of subsequent generations. The roots of modern scientific studies are deep.

Professor Lou Cheng-Hou (1911–2009) was a celebrated educator and plant physiologist in China. Professor Lou graduated from National Tsing-Hua University in 1932 and obtained his Ph.D. from the University of Minnesota in 1939. He conducted plant physiological research and education for more than 70 years and educated hundreds of students. His research achievements dealt mainly with the roles of materials transport and information transmission in integrating higher plant behavior in response to environmental changes. He discovered that high-molecular-weight materials (including viruses) were transported through intercellular plasmodesmatal channels driven by protoplasmic movement, and that rapid electrical waves and specific signaling hormones transmitted information through both symplasmic and apoplastic connections. He was among the first scientists to study and advocate the application of plant hormones (e.g., auxin), their analogs (e.g., 2,4-dichlorophenoxyacetic acid), synthetic bio-regulators, and weed killers for field crops. For his great achievements, Professor Lou was elected to be a member of the Chinese Academy of Sciences in 1981, and was awarded an Honorary Doctorate of Science by the University of Minnesota in 2001.

For the 100th anniversary of Professor Lou's birth, a special topic was organized of the English version of *Chinese Science Bulletin* (2011, Vol. 56, Number 33). In this Special Topic, the former students of Professor Lou, many of them now occupying important positions in China or abroad, present novel research or give comprehensive reviews of their research fields.

Stomata are important to control plant gas exchange, and guard cells are now an important model for the study of signal transduction. Stomatal movement was studied in Professor Lou's group for many years. In this Special Topic, two papers describe the work on stomatal movement by Professor Wang XueChen's group at China Agricultural University. One paper [1] presents an α-expansin, VfEXPA1, that is expressed primarily in guard cells. Expression of *VfEXPA1* is regulated by darkness but is not affected by light or abscisic acid (ABA). Overexpression of *VfEXPA1* in tobacco accelerates light-induced stomatal opening. Therefore, VfEXPA1 may play an important role in regulating stomatal opening. Another paper [2] presents this group's work on the role of hydrogen sulfide (H_2S). They provide evidence that H_2S induced by nitric oxide (NO) mediates ethylene-induced stomatal closure in *Arabidopsis thaliana*. Their work not only indicates that H_2S and NO are involved in the signal transduction pathway during ethylene-induced stomatal closure, it also suggests that H_2S may represent a novel downstream indicator of NO during ethylene-induced stomatal movement. In addition, Dr. Zhu GuoLi, at China Agricultural University, reports on that lab's work on pH-induced elastic modulus of guard-cell walls during stomatal movement [3]. They investigated the volumetric elastic modulus (ε) of guard-cell walls at different pH levels during stomatal opening in *Vicia faba* by using a cell pressure probe. They discovered that the volumetric elastic modulus of the guard-cell wall decreases with the

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cell wall pH. Their work suggests that cell-wall pH might have a role in regulating stomatal movement.

Professor Lou dedicated much of his efforts to studying how information transmission integrates the responses of higher plants to environmental changes. In this Special Topic Issue, Professor Song Chun-Peng, at Henan University, reports that BGLU10, a vacuole localized β-glucosidase, contributes to drought tolerance in *Arabidopsis* [4]. Increased levels of ABA and expressions of ABA-and drought-responsive genes under drought stress were detected in the T-DNA insertion mutant *bglu10*, but decreased ABA levels and expressions of these genes under drought stress were detected in lines overexpressing *BGLU10*. Furthermore, *BGLU10* was also induced by several abiotic stresses. This study suggests that BGLU10 may be involved in a variety of stress responses and that hydrolysis of ABA glucose ester produces free ABA in response to abiotic stresses. In addition, Professor Wang XueChen's group reported the identification of AtSM34, a novel tonoplast intrinsic protein-interacting polypeptide expressed in response to osmotic stress in germinating seedlings [5]. *AtSM34* is expressed in various tissues, particularly in vascular tissues, in response to osmotic stress. Overexpression of *AtSM34* results in hypersensitivity to exogenous mannitol, sorbitol, and abscisic acid and a significant delay in germination. AtSM34 interacts with AtTIP1;2 and AtTIP2;1, which are essential to modulate tonoplast permeability and are highly expressed in germinating seedlings. These data indicate that AtSM34 is a novel TIP-binding protein involved in the osmotic-stress response of seedlings at early developmental stages.

Several review papers are also included in this Special Topic Issue. Professor Ren HaiYun, at Beijing Normal University, reviewed the dynamics and functions of the actin cytoskeleton during the plant cell cycle [6]. She reviewed recent research on the dynamic distribution of the actin cytoskeleton and actin-binding proteins and the mechanisms by which they affect the progression of the plant cell cycle. Professor Shen WenHui, at Université de Strasbourg in France, reviewed the crucial functions of histone lysine methylation in plant reproduction [7]. They describe the known functions of histone lysine methylation in various stages of reproduction in *A. thaliana* and suggest that histone lysine methylation is a key to understanding epigenetic regulation networks of genome function. Dr. Ding DaQiao, at the National Institute of Information and Communications Technology in Japan, reviewed chromosome dynamics during meiosis [8]. She describes the "horse tail" nucleus, the premeiotic nucleus in the fission yeast *Schizosaccharomyces pombe*, and summarizes research evidence and references on dynamic "horsetail movement" and "bouquet arrangements" in the horsetail nucleus. Study of the horsetail nucleus in fission yeast offers insight into the mechanisms of meiosis. Furthermore, Dr. Wang YouQun, at China Agricultural University, reviews and describes how plant grafting is used in various biological research projects, especially in the translocation of substances and long-distance signaling in plants [9], topics much emphasized in Professor Lou's long-term studies.

The passion for and dedication to science that has passed from an older generation to the new is gratifying to witness. The memory of our teacher remains in our minds and inspires us to pursue our scientific goals.

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